WHAT IS CLAIMED IS:

1. A base station transmitter, comprising:

a predistortion unit that predistorts first and second phase digital input signals I and Q;

an up-converting unit that converts digital output signals of the predistortion unit into an RF signal;

a power amplifier that amplifies a power of the RF signal outputted from the up-converting unit;

a down-converting unit that converts an output signal of the power amplifier into a digital signal;

a High Power Amplifier (HPA) modeling unit that produces a coefficient of a non-linear characteristic model of the power amplifier using signals obtained by delaying outputs of the predistortion unit for a predetermined time and the digital signal outputted from the down-converting unit;

a reference signal generation unit that generates reference signals to produce a predistortion model; and

a digital adaptive control unit that extracts an error function using the reference signals and the produced coefficient, wherein

the digital adaptive control unit controls characteristics of the predistortion unit adaptively using the error function.

2. The transmitter of claim 1, wherein the up-converting unit comprises;

a digital/analog converter that converts the predistorted first and second phase digital input signals I and Q into analog signals, respectively; and

a modulation unit that modulates the analog signals outputted from the digital/analog converter and outputs the modulated analog signals to the power amplifier as the RF signal.

3. The transmitter of claim 1, wherein the down-converting unit comprises:

a demodulation unit that demodulates a signal sampled from the RF signal amplified by the power amplifier; and

an analog/digital converter that converts an analog signal, outputted from the demodulation unit, to the digital signal and outputs the digital signal to the HPA modeling unit.

4. The transmitter of claim 1, wherein the HPA modeling unit comprises:

an inphase coefficient generating function block that makes the predistorted first phase digital input signal I, which is outputted from the predistortion unit, have a first predetermined amplitude, extracts an HPA inphase error function by comparing the predistorted first phase digital input signal I to a first phase output signal I extracted from the output signal of the power amplifier, and extracts an unknown coefficient of an HPA inphase model using the extracted HPA inphase error function; and

a quadrature coefficient generating function block that makes the predistorted second phase digital input signal Q, which is outputted from the predistortion unit, have a second predetermined amplitude, extracts an HPA quadrature error function by comparing the predistorted second phase digital input signal Q to a second phase output signal Q extracted from the output signal of the power amplifier, and extracts an unknown coefficient of an HPA quadrature model using the extracted HPA quadrature error function.

5. The transmitter of claim 1, wherein the HPA modeling unit comprises:

a signal amplitude generation unit that outputs an amplitude value of the predistorted first and second phase digital input signals I and Q, which are delayed for the predetermined time by a delay unit, to have the same output level as the power amplifier;

a first multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted first phase digital input signal I, after the predistorted first phase digital input signal I passes through the delay unit and an HPA inphase model module;

a first subtracter that extracts an HPA inphase error function by subtracting an output signal of the first multiplier and a first phase digital signal I outputted from the down-converting unit;

a second multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted second phase digital input signal Q, after the

predistorted second phase digital input signal Q passes through the delay unit and an HPA quadrature model module; and

a second subtracter that extracts an HPA quadrature error function by subtracting an output signal of the second multiplier and a second phase digital signal Q outputted from the down-converting unit, wherein

the inphase model module determines an unknown coefficient I by applying the HPA inphase error function to an HPA inphase model through a Recursive Least Square (RLS) method, and

the quadrature model module determines an unknown coefficient Q by applying the HPA quadrature error function to an HPA quadrature model through the RLS method.

6. The transmitter of claim 1, wherein the digital adaptive control unit comprises:

an HPA model output unit that generates an HPA model by applying the coefficient produced by the HPA modeling unit and amplifies the reference signals that are predistorted by the predistortion model using the HPA model;

a first subtracter that extracts a predistortion inphase error function by subtracting an amplitude component of a first phase reference signal, generated by the reference signal generation unit, and an output amplitude component I of the HPA model output unit;

a second subtracter that extracts a predistortion quadrature error function by subtracting an amplitude component of a second phase reference signal, generated by the

reference signal generation unit, and an output amplitude component Q of the HPA model output unit; and

a predistortion model module that predistorts the reference signals, generated from the reference signal generation unit, using the predistortion model to output predistorted reference signals to the HPA model output unit and updates predistortion coefficients of the predistortion unit by applying the inphase and quadrature error functions extracted, respectively, by the first and second subtracters to the predistortion model.

7. A base station transmitter, comprising:

a predistortion unit that predistorts first and second phase digital input signals;

a digital/analog converter that converts the first and second phase digital input signals into analog signals, respectively;

a modulation unit that modulates the analog signals outputted from the digital/analog converter and outputs the modulated analog signals as RF signals;

a power amplifier that amplifies the power of the RF signals outputted from the modulation unit;

a demodulation unit that demodulates a signal sampled from the RF signals amplified by the power amplifier;

an analog/digital converter that converts analog signals outputted from the demodulation unit;

a delay unit that delays the predistorted first and second phase digital input signals, sampled from outputs of the predistortion unit, for a predetermined time;

an HPA modeling unit that produces a coefficient of a non-linear characteristic model of the power amplifier using digital signals outputted from the analog/digital converter and output signals of the delay unit;

a reference signal generation unit that generates reference signals to produce a predistortion model; and

a digital adaptive control unit that extracts an error function using the reference signals and the non-linear characteristic model of the power amplifier, modeled using the produced coefficient, and controls characteristics of the predistortion unit adaptively, using the error function.

8. The transmitter of claim 7, wherein the HPA modeling unit comprises:

an inphase coefficient generating function block that makes the predistorted first phase digital input signal, which is outputted from the predistortion unit, have a first predetermined amplitude, extracts an HPA inphase error function by comparing the predistorted first phase digital input signal to a first phase output signal extracted from an output of the power amplifier, and extracts an unknown coefficient I of an HPA inphase model using the extracted HPA inphase error function; and

a quadrature coefficient generating function block that makes the predistorted second phase digital input signal, which is outputted from the predistortion unit, have a second

predetermined amplitude, extracts an HPA quadrature error function by comparing the predistorted second phase digital input signal to a second phase output signal extracted from the output of the power amplifier, and extracts an unknown coefficient Q of an HPA quadrature model using the extracted HPA quadrature error function.

9. The transmitter of claim 7, wherein the HPA modeling unit comprises:

a signal amplitude generation unit that outputs an amplitude value of the predistorted first and second phase digital input signals, which are delayed for the predetermined time by the delay unit, to have the same output level as the power amplifier;

a first multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted first phase digital input signal, after the predistorted first phase digital signal passes through the delay unit and an inphase model module;

a first subtracter that extracts an HPA inphase error function by subtracting an output signal of the first multiplier and a first phase digital signal outputted from the analog/digital converter;

a second multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted second phase digital input signal, after the predistorted second phase input signal passes through the delay unit and a quadrature model module; and

a second subtracter that extracts an HPA quadrature error function by subtracting an output signal of the second multiplier and a second phase digital signal outputted from the analog/digital converter; wherein

the inphase model module determines an unknown coefficient I by applying the HPA inphase error function to an HPA inphase model through a recursive least square (RLS) method, and

the quadrature model module determines an unknown coefficient Q by applying the HPA quadrature error function to an HPA quadrature model through the RLS method.

10. The transmitter of claim 7, wherein the digital adaptive control unit comprises:

an HPA model output unit that generates an HPA model, using the coefficient produced by the HPA modeling unit, and amplifies the reference signals, after the reference signals are predistorted by the predistortion model, using the HPA model;

a first subtracter that extracts a predistortion inphase error function by subtracting an amplitude component of a first phase reference signal, generated by the reference signal generation unit, and a first output amplitude component of the HPA model output unit;

a second subtracter that extracts a predistortion quadrature error function by subtracting an amplitude component of a second phase reference signal, generated by the reference signal generation unit, and a second output amplitude component of the HPA model output unit; and

a predistortion model module that predistorts the reference signals, generated from the reference signal generation unit, using the predistortion model to output predistorted reference signals to the HPA model output unit and updates predistortion coefficients of the predistortion unit by applying the inphase and quadrature error functions extracted from the first and second subtracters, respectively, to the predistortion model.

11. A predistortion control apparatus, comprising:

a predistortion unit that predistorts input signals to be opposite to a non-linear characteristic of a power amplifier and outputs predistorted first and second phase digital input signals;

a high power amplifier (HPA) modeling unit that produces a coefficient of a non-linear characteristic model of the power amplifier using a digital output signal, converted from an output signal of the power amplifier, and the predistorted first and second phase digital input signals; and

a digital adaptive control unit that extracts an error function using reference signals and the non-linear characteristic model of the power amplifier, modeled using the produced coefficient, and controls characteristics of the predistortion unit adaptively, using the error function.

12. The apparatus of claim 11, further comprising:

a delay unit that delays the predistorted first and second phase digital input signals, sampled from outputs of the predistortion unit for a predetermined time, before the respective signals are communicated to the HPA modeling unit; and

a reference signal generation unit that generates the reference signals used to produce a predistortion model.

13. The apparatus of claim 11, wherein the HPA modeling unit comprises:

an inphase coefficient generating function block that makes the predistorted first phase digital input signal, which is outputted from the predistortion unit, have a first predetermined amplitude, extracts an HPA inphase error function by comparing the predistorted first phase digital input signal to a first phase output signal extracted from the output signal of the power amplifier, and extracts an unknown coefficient of an HPA inphase model using the extracted HPA inphase error function; and

a quadrature coefficient generating function block that makes the predistorted second phase digital input signal, which is outputted from the predistortion unit, have a second predetermined amplitude, extracts an HPA quadrature error function by comparing the predistorted second phase digital input signal to a second phase output signal extracted from the output signal of the power amplifier, and extracts an unknown coefficient of an HPA quadrature model using the extracted HPA quadrature error function.

14. The apparatus of claim 12, wherein the HPA modeling unit comprises:

a signal amplitude generation unit that outputs an amplitude value of the predistorted first and second phase digital input signals, which are delayed for the predetermined time by the delay unit, to have the same output level as the power amplifier;

a first multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted first phase digital input signal, after the predistorted first phase digital input signal is passed through the delay unit and an inphase model module;

a first subtracter that extracts an HPA inphase error function by subtracting an output signal of the first multiplier and a first phase digital signal converted from the output signal of the power amplifier;

a second multiplier that multiplies the amplitude value outputted from the signal amplitude generation unit by the predistorted second phase digital input signal, after the predistorted second phase digital input signal passes through the delay unit and a quadrature model module; and

a second subtracter that extracts an HPA quadrature error function by subtracting an output signal of the second multiplier and a second phase digital signal converted from the output signal of the power amplifier, wherein

the inphase model module determines an unknown coefficient I by applying the HPA inphase error function to an HPA inphase model, and

the quadrature model module determines an unknown coefficient Q by applying the HPA quadrature error function to an HPA quadrature model.

15. The apparatus of claim 12, wherein the digital adaptive control unit comprises:

an HPA model output unit that generates an HPA model, using the coefficient produced by the HPA modeling unit, and amplifies the reference signals, after the reference signals are predistorted by the predistortion model, using the HPA model;

a first subtracter that extracts a predistortion inphase error function by subtracting an amplitude component of a first phase reference signal, generated by the reference signal generation unit, and an output amplitude component I of the HPA model output unit;

a second subtracter that extracts a predistortion quadrature error function by subtracting an amplitude component of a second phase reference signal, generated by the reference signal generation unit, and an output amplitude component Q of the HPA model output unit; and

a predistortion model module that predistorts the reference signals, generated from the reference signal generation unit, using the predistortion model, outputs the predistorted reference signals to the HPA model output unit, and updates predistortion coefficients of the predistortion unit by applying the predistortion inphase and quadrature error functions extracted from the first and second subtracters, respectively, to the predistortion model.

16. A predistortion control method, comprising:

delaying a digital input signal, predistorted by a predistortion unit, for a predetermined time;

generating a first coefficient of a non-linear characteristic model of a power amplifier using a digital output signal, converted from an amplified output signal of the power amplifier, and the delayed digital input signal;

generating a substantially random reference signal;

producing a predistortion model having a characteristic opposite to a non-linear characteristic of the power amplifier using the random reference signal;

generating the non-linear characteristic model of the power amplifier using the first coefficient;

extracting a predistortion error function by subtracting the reference signal from the non-linear characteristic model of the power amplifier; and

controlling a second coefficient of the predistortion unit adaptively using the predistortion error function.

17. The method of claim 16, wherein generating the first coefficient comprises:

outputting an amplitude of the predistorted digital input signal to have the same amplification level as the power amplifier;

multiplying the predistorted digital input signal by the outputted amplitude;

extracting an HPA error function by comparing a product of the multiplication to the digital output signal; and

generating the first coefficient by applying the extracted HPA error function to the non-linear characteristic model of the power amplifier through a recursive least squares (RLS) method.

18. The method of claim 16, wherein controlling the second coefficient of the predistortion unit adaptively comprises:

generating the non-linear characteristic model of the power amplifier using the generated first coefficient;

predistorting the reference signal using the predistortion model and amplifying the predistorted reference signal using the generated non-linear characteristic model of the power amplifier;

extracting the predistortion error function by comparing an amplitude component of the reference signal to an amplitude component of the amplified and predistorted reference signal; and

updating the second coefficient of the predistortion unit adaptively by applying the extracted predistortion error function to the predistortion model.